

CLAIMS:

1. A mass polymerized rubber-modified monovinylidene aromatic copolymer composition comprising:

- 5 (i) a continuous matrix phase comprising a copolymer of a monovinylidene aromatic monomer and an ethylenically unsaturated nitrile monomer and
(ii) a rubber component dispersed as discrete rubber particles in the matrix comprising
(a) a polybutadiene rubber with a 5 weight percent solution viscosity in styrene at 25°C of between 15 to 120 cP and
10 (b) a styrene and butadiene block copolymer rubber

wherein the rubber component has a polybutadiene content (PBD_c) equal to or greater than about 14 weight percent based on the weight of the copolymer composition and the matrix copolymer has a weight average molecular weight (M_w Matrix) represented by the formula:

15
$$(M_w \text{ Matrix}) \geq 510 - 22 * PBD_c.$$

2. The mass polymerized rubber-modified monovinylidene aromatic copolymer composition of Claim 1 wherein the ethylenically unsaturated nitrile is from about 10 to about 35 weight percent of the copolymer.

3. The mass polymerized rubber-modified monovinylidene aromatic copolymer composition of Claim 1 wherein the monovinylidene aromatic monomer is styrene and the ethylenically unsaturated nitrile monomer is acrylonitrile.

4. The mass polymerized rubber-modified monovinylidene aromatic copolymer composition of Claim 1 further comprising a comonomer selected from n-butyl acrylate or N-phenyl maleimide.

25 5. The mass polymerized rubber-modified monovinylidene aromatic copolymer composition of Claim 1 wherein:

- (i) the copolymer is present in an amount from about 40 to 86 weight percent and
(ii) the rubber component is present in an amount from about 60 to 14 weight percent,
30

wherein weight percents are based on the total weight of the rubber-modified monovinylidene aromatic copolymer.

6. The mass polymerized rubber-modified monovinylidene aromatic copolymer composition of Claim 1 wherein

- (a) the polybutadiene rubber comprises a linear rubber, a branched rubber, a hyper-branched rubber, or mixture thereof and
- 5 (b) the styrene and butadiene block copolymer rubber comprises a linear rubber, a branched rubber, a hyper-branched rubber, or mixture thereof.

7. The mass polymerized rubber-modified monovinylidene aromatic copolymer composition of Claim 1 wherein

- (a) the polybutadiene rubber is a branched rubber of three or more arms and
- 10 (b) the styrene and butadiene block copolymer rubber is a linear rubber.

8. The mass polymerized rubber-modified monovinylidene aromatic copolymer composition of Claim 1 wherein the rubber component comprises a functionalized styrene and butadiene block copolymer rubber.

9. The mass polymerized rubber-modified monovinylidene aromatic copolymer composition of Claim 6 wherein the block copolymer is functionalized with 2,2,6,6,-tetramethyl-1-piperidinyloxy; 2,2,6,6-tetramethyl-1-[1-[4-(oxiranylmethoxy) phenyl]ethoxy]-piperidine; or 3,3,8,8,10,10-hexamethyl-9-[1-(4-oxiranylmethoxyphenyl)-ethoxy]-1,5-dioxa-9-azaspiro[5.5]undecane.

10. The mass polymerized rubber-modified monovinylidene aromatic copolymer composition of Claim 1 wherein the rubber particles have an average particle size from about 0.5 to about 1 micrometers.

11. The mass polymerized rubber-modified monovinylidene aromatic copolymer composition of Claim 1 having a light absorbance ratio from about 1 to about 3.

12. A mass polymerized rubber-modified monovinylidene aromatic copolymer composition having a notched Charpy impact strength equal to or greater than 18 kJ/m² at a temperature of -30°C.

13. A method for preparing a mass polymerized rubber-modified monovinylidene aromatic copolymer composition comprising the steps of:

- 30 (i) polymerizing by bulk, mass-solution or mass-suspension polymerization techniques in the presence of a dissolved rubber component a monovinylidene aromatic monomer and an ethylenically unsaturated nitrile monomer, optionally in the presence of an inert solvent, to the desired degree of conversion and

- (ii) subjecting the resultant mixture to conditions sufficient to remove any unreacted monomers and to cross-link the rubber, wherein the polymerized monovinylidene aromatic monomer and the ethylenically unsaturated nitrile monomer comprise a matrix copolymer and
- 5 wherein the rubber component
- (a) comprises a polybutadiene rubber with a 5 weight percent solution viscosity in styrene at 25°C of between 15 to 120 cP and a styrene and butadiene block copolymer rubber and
- 10 (b) has a polybutadiene content (PBD_c) equal to or greater than about 14 weight percent based on the weight of the copolymer composition and the matrix copolymer has a weight average molecular weight (M_w Matrix) represented by the formula: $(M_w \text{ Matrix}) \geq 510 - 22 * PBD_c$
14. The method of Claim 13 wherein the monovinylidene aromatic monomer is
- 15 styrene and the ethylenically unsaturated nitrile monomer is acrylonitrile.
15. The method of Claim 13 wherein the polybutadiene rubber is a branched rubber of three or more arms and the styrene and butadiene block copolymer a linear rubber.
16. The method of Claim 13 wherein the styrene and butadiene block copolymer is functionalized with 2,2,6,6,-tetramethyl-1-piperidinyloxy; 2,2,6,6-tetramethyl-1-[1-[4-(oxiranylmethoxy) phenyl] ethoxy]-piperidine; or 3,3,8,8,10,10-hexamethyl-9-[1-[4-(oxiranylmethoxy)phenyl] ethoxy]-1,5-dioxo-9-azaspiro[5.5]undecane.
- 20
17. A method for producing a molded or extruded article of a mass polymerized rubber-modified monovinylidene aromatic copolymer composition comprising the steps of:
- (A) preparing a mass polymerized rubber-modified monovinylidene aromatic
- 25 copolymer composition comprising
- (i) a continuous matrix phase comprising a copolymer of a monovinylidene aromatic monomer and an ethylenically unsaturated nitrile monomer and
- (ii) a rubber component dispersed as discrete rubber particles in the matrix
- 30 comprising
- (a) a polybutadiene rubber with a 5 weight percent solution viscosity in styrene at 25°C of between 15 to 120 cP and
- (b) a styrene and butadiene block copolymer

wherein the rubber component has a polybutadiene content (PBD_c) equal to or greater than about 14 weight percent based on the weight of the copolymer composition and the matrix copolymer has a weight average molecular weight (Mw Matrix) represented by the formula:

5 $(Mw \text{ Matrix}) \geq 510 - 22 * PBD_c,$

and

(B) molding or extruding said rubber-modified monovinylidene aromatic copolymer composition into a molded or extruded article having.

18. The method of Claim 17 wherein the molded or extruded article is a sheet or
10 coextruded sheet with another polymer.

19. The method of Claim 18 wherein the other polymer is PMMA or ASA.

20. The method of Claim 17 wherein the molded or extruded article is a
household appliance, a toy, an automotive part, an extruded pipe, an extruded profile, a
sheet, a sanitary application, a power tool housing, a telephone housing, a computer
15 housing, signage, luggage, or copier housing.

21. The composition of Claim 1 in the form of a molded or extruded article.

22. The molded or extruded article of Claim 21 is a household appliance, a toy,
an automotive part, an extruded pipe, an extruded profile, a sheet, a sanitary application, a
power tool housing, a telephone housing, a computer housing or a copier housing.